Project Title: Determination of Isotopic Uranium at Ultra-Low Concentrations in Synthetic Urine

Project Description: At the request of representatives of the Los Alamos National Laboratory (LANL), a meeting of international experts was held in Santa Fe on February 26 and 27, 2002 to discuss the need to conduct a study on the capability of mass spectrometric methods to measure isotopic uranium at ultra-low concentrations in bioassay samples. The technical criteria and plans for an independent evaluation and validation of current and emerging uranium measurement technologies were developed, as a consensus, by the experts attending the meeting. The experimental design of the study, as presented under DOE RESL item 1 of the deliverables, was derived from statistical orthogonal-design theory.

The Radiological and Environmental Sciences Laboratory (RESL) of the Department of Energy has the expertise and capability to prepare the unique test samples. RESL maintains traceability to the National Institute of Standards and Technology (NIST) to prepare performance-testing samples under the DOE – NIST Radiological Traceability Program administered and funded by the DOE National Analytical Management Program. Since the Santa Fe meeting, RESL has developed the chemical methods to prepare uranium-free synthetic urine samples. Uranium isotopes in various ratios and concentrations will be added to these uranium-free samples.

Various national laboratories and government agencies have expressed funding support to conduct this study in CY2002. LANL has committed financial support to participate in this study.

Project Deliverables:
DOE RESL: The following deliverables will be provided by RESL;

1) Test Samples. RESL shall prepare and provide to the laboratory synthetic urine test samples consistent with the following testing levels and isotopic ratios:

U-238 Level (ng / L)	U-235 / U-238 Isotopic Ratio (%)*	# of Samples***
250	0.4 – 0.5	3
250	0.6 – 0.8	3
250	0.9 – 1.1	3
50	0.4 – 0.5	3
50	0.6 – 0.8	3
50	0.9 – 1.1	3
5ψ	0.4 – 0.5	3
5ψ	0.6 – 0.8	3
5ψ	0.9 – 1.1	3
Blanks**	-	5

* U-236 will be inherent in each test sample. The U-236 / U-238 ratio of the test samples will vary according to the inherent U-236 in the standards obtained from the New Brunswick Laboratory.
** The isotopic uranium content of the blank samples will be documented by RESL.
*** The sample identification number will be selected at random.
ψ Test level availability depends on the degree of uranium inherent in the blank synthetic urine samples.

2) Certificate of Content. Documentation shall be provided to the laboratory that includes a certified value and estimated combined standard uncertainty for the concentrations of U-235, U-236 and U-238 or the isotopic ratio (relative to U-238) of each test sample.

3) Report. A report will be compiled that includes documentation on the inherent uranium content in the blank synthetic urine, RESL's dilution and verification scheme for the preparation of the test samples, Certificates of Content for the test samples, the laboratory's test method and reported analytical results, a statistical evaluation of the test results submitted by the laboratory to determine the difference between the laboratory's results and the certified values for the isotopic ratios, and a summary of a regression analysis of the reported isotopic ratio values versus the U-238 level.

4) Meeting / Presentation. RESL shall meet with participant laboratories' representatives to discuss the study findings. A summary of the study findings shall be presented in a Power Point format.

The participant laboratory will provide the following deliverables;

1) The laboratory will analysis each test and blank sample through chemical preparation / mass spectrometric means and report for each sample the concentration of U-235 and U-238 with associated combined standard uncertainty.

2) The laboratory will provide a summary of the analytical method used to analyze the test samples.

Schedule for Deliverables: RESL shall prepare, certify and submit the test samples to the participating laboratory. The laboratory shall complete the analysis of the samples within three months of their receipt.

RESL shall prepare a report, as described above, within three months after the receipt of the participant laboratory test results. A meeting shall be scheduled with the laboratory's representatives one month after the laboratory's review of the report.

Participant Laboratory Costs: $20,000.